

University of Cambridge  
School of Agriculture Memoirs



Memoir No. 10

A brief summary of the papers published by the Staffs of the School of Agriculture and its Associated Research Institutes during the period Oct. 1st, 1937—Sept. 30th, 1938.



1938

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#### FOREWORD.

This Memoir, which is published under the general editorship of the Librarian of the School, represents an attempt to present as succinctly as possible the contributions made by members of the Staffs of the School of Agriculture and its Associated Institutes to the development and progress of Agricultural Science, to indicate to research workers interested the Journals in which the full papers are presented and to act as a complete record of papers published. Each summary is compiled by the author of the paper and is presented, so far as the subject matter will allow, in a non-technical form in order to be of value to the general body of farmers interested in the more recent developments of agricultural scientific research in general and of the activities of this Department in particular.

Requests for further information or criticism arising out of the summaries should be referred to the individual author concerned, criticisms and suggestions for the improvement of the Memoir itself should be addressed to the Librarian of the School.

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**Members of Staffs, summaries of whose papers are included in these Memoirs.**

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# University of Cambridge School of Agriculture Memoirs

## THE SCHOOL OF AGRICULTURE INCLUDING ESTATE MANAGEMENT, THE ADVISORY SERVICES AND ASSOCIATED RESEARCH INSTITUTES

*Agricultural Education in Cambridge dates from 1892 when the Cambridge and Counties Agricultural Education Committee, an informal body consisting of University Professors and County Council representatives, first organized an Agricultural Course. In 1899 the University created a Department of Agriculture to take over the work of this Committee. The School of Agriculture was built by public subscription in 1909 and expanded by a grant from the Development Commission in 1912. The rapid expansion of the Animal Nutrition Institute and the Plant Breeding Institute under the direction of Professor T. B. Wood and Professor R. H. Biffen led to increased demands on accommodation, and an extension to the building was made in 1925-26 by the aid of a further grant from the Development Commission. The Estate Management Branch has been added since the war for the purpose of providing technical and professional assistance in the management of University and College property and with a view to affording opportunities for practical demonstrations in connection with the teaching of Estate Management subjects.*

*The Rockefeller Benefaction, made to the University in 1929, provided money for additional accommodation for the Department of Agriculture and for an expansion of its activities, and a new building was completed and occupied in March, 1933.*

*The Department of Agriculture is a teaching department of the University and offers courses of instruction leading to a degree or a post-graduate diploma. Research in the problems of agriculture and cognate sciences is carried out by members of the teaching staff and by members of the staffs of the Research Institutes attached to the Department. There are also a number of advisory officers who are available to offer assistance and advice to farmers on their problems. Additional facilities for both teaching and research are provided by the University Farm which occupies an area of some 700 acres within reasonable distance of the scientific laboratories.*



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## AGRICULTURE.

551\* GARNER, F. H. & SANDERS, H. G.

### The Effect of the Gyrotiller on Crop Yield.

*J. Agric. Sci.* 1938, **28**, 401-417.

In two experiments on heavy land (one continued for four, and the other for three years) gyrotilling has been compared with normal cultivations, and no significant increase in yield has been obtained, although in five out of seven experimental crops the actual difference was very slightly in favour of gyrotilling.

In two experiments on light land (one continued for three, and one for two years) gyrotilling has been compared with normal cultivations (ploughing and subsoiling, and also, in one case, ploughing alone), and in all five experimental crops there was a slight depression in yield, which was only significant in one case, connected with gyrotilling.

HAMMOND, J.

### Appraisal and Judging of Pig Carcasses.

*J. Dep. Agric. Vict.* 1938, **36**, 261-269.

An account of a score card system of judging pork and bacon carcasses.

MANSFIELD, W. S.

### A System of Alternate Husbandry as Applied to Heavy Clay Soils in the Eastern Counties.

*3rd Oxford Fmg Conf.* 1938, pp. 38-46.

SANDERS, H. G. & GARNER, F. H.

### The Place of Silage in British Agriculture.

*3rd Oxford Fmg Conf.* 1938, pp. 75-80.

WOODMAN, H. E. & AMOS, A.

### Ensilage. 4th ed.

*Bull. No. 37, Minist. Agric.* 1938. (H.M.S.O., London, Price 1s. net).

## OTHER PAPERS.

BIFFEN, R. H.

### Annual Report for 1937 of the Botanist.

*J. R. Agric. Soc.* 1937, **98**, 554-560.

BUTTRESS, F. A.

### 17th Century "Secrets".

*Camb. Univ. Agric. Soc. Mag.* 1938, **5** (No. 3), 26-27.

DENNIS, R. W. G.

### Agriculture in Iceland.

*Scot. Fmr.* 1938, **46**, 80.

ENGLEDOW, F. L.

### Higher Education in Agriculture.

*Times. Brit. Agric.* No. 1st Feb., 1938. p. xxix.

ENGLEDOW, F. L.

### To Improve the Quality of Farm Produce.

*Fmrs' Wkly.* 1938, **8** (No. 8), 15.

MANSFIELD, W. S.  
**Heavy Land in the Eastern Counties.**  
*Fmr's Wkly.* 1938, 8 (No. 1), 32.

MANSFIELD, W. S.  
**The University Farm, 1937.**  
*Camb. Univ. Agric. Soc. Mag.* 1938, 5 (No. 3), 5-9.

SANDERS, H. G.  
**Autumn-sown Barley.**  
*Fmr & Stk-Breed.* 1938, 52, 2090.

SANDERS, H. G.  
**The Effect of the Gyrotiller on Soil and Crop.**  
*Agric. Progr.* 1938, 15, 16-20.

SANDERS, H. G.  
**Roots Should be Treated Well.**  
*Fmr & Stk-Breed.* 1938, 52, 344.

SANDERS, H. G.  
**Spacing the Sugar Beet.**  
*Fmr & Stk-Breed.* 1938, 52, 1335.

SANDERS, H. G.  
**Spring Attentions to Winter Wheat.**  
*Fmr's Wkly.* 1938, 8 (No. 10), 36.

#### AGRICULTURAL CHEMISTRY.

526\* FOREMAN, F.W.  
**Observations on the Proteins of Pasturage, Phosphorus and Protoplasm.**  
*J. Agric. Sci.* 1938, 28, 135-173.

Studies lead to the conclusion that Chibnall-preparations of pasturage proteins, in spite of their small amounts of carbohydrate impurity, may yet yield, on hydrolysis by mineral acids, practically the right amounts even of most of those amino-acids which are adversely affected by carbohydrates to some extent when tested singly under the conditions.

Preparations made in another way after treating the pasturage with ether as in the original Chibnall-method showed features of interest in the problem of attaining very pure proteins now much needed for purposes of comparison.

A new method is introduced by which it is possible to compare what may be extracted from the protoplasm of fresh unpulverized pasturages with the composition of the natural saps on a unit weight basis.

Production and breakdown of protoplasmic protein in perennial rye-grass during growth consistently appeared related to variations in the content of "nitrogen" and phosphates in the saps and the supplies of "nitrogen" and phosphates from the soil.

Proteins occur in the protoplasm of perennial rye-grass as "greater complexes" in which they are associated with phosphorous substances.

Two types of "greater complexes" are distinguished by their behaviour towards water, viz. "Complex a", containing water-soluble phosphorous substances, probably phosphates of K or Na chiefly, and "Complexes b", "rigid towards water", probably including Ca or Mg phosphate-protein as part of the cytoplasm.

The saps lose and gain nitrogenous materials and phosphates in relation to requirements in the production and excretions after the breakdown of the "greater complexes" of the protoplasm.

The content of "Complex a" in the protein-containing-complexes of the protoplasm varies with (1) protein production and breakdown during growth, (2) stage of growth in relation to the

sequence of events in the life history of the grass, (3) conditions in the grass as determined by the weather, (4) the relative amounts of mineral radicles supplied by the soil in varying weather and manuring.

"Complex *a*" fluctuates as a protein reserve or store and its content in the protein-containing-complexes of the protoplasm of grass fodders may be a matter of considerable nutritional importance.

The results suggest a fundamental basis for the term "balance" often used in discussing problems of manuring and the methods seem suitable for elucidating other aspects of supply and demand in growth processes.

Probably the content of "Complex *a*" in the protein-containing-complexes of the protoplasm of grasses determines the yield of the "soluble proteins" from the Chibnall-methods.

## AGRICULTURAL ECONOMICS.

### An Economic Study of Pig Production.

*Fm Econ. Br. Rep.* No. 25. Pp. vi + 49. Price 1/6 net. Postage 2d.

This Report covers the period April, 1936 to March, 1937, and is concerned with the organization and financial results of the pig enterprise on a group of 33 farms in the Eastern Counties. It does not claim to present a picture of "average" conditions in pig production, but rather to indicate what can be, and is, in fact, being accomplished under different systems of management.

Taken together the financial results of pig keeping in the herds concerned were satisfactory. The net profit for the year averaged £17 $\frac{1}{2}$  per £100 of gross output, and although a rise in the price of feeding stuffs occurred in the second half of the year, the resultant increase in costs was largely offset by higher pig prices. The full effect of this rise in the price of feeding stuffs was not, however, apparent in the period under review owing to the fact that in several of the larger herds requirements had been bought for forward delivery till Christmas.

During the first half of the year pigs sold in the open market made more than those sent to bacon factories, but the position was reversed after the breakdown of the Pigs Marketing Scheme. For the whole year factory pigs averaged 5d. a score live weight less than those sent to market.

Profits varied widely between herds. No herd producing pork or bacon pigs lost money, but during the year the production of weaners for sale appeared to be unprofitable. In the 26 herds which kept breeding stock an average of 1 $\frac{1}{2}$  cwt. of meal was required to produce a weaner. In fattening bacon pigs from weaning to slaughter an average of just over 4lb. of meal per lb. live weight gain was used. In individual herds the amount of meal required to produce one lb. of live weight bacon pig ranged from 3.81 to 4.56 lb., this range representing a difference of one cwt. of meal, or a cash difference of approximately 8/-, in the production of a 200 lb. pig.

For all herds an average of 9.7 pigs were born alive and 7.9 weaned per litter, while 18.5 per cent of pigs born died before weaning. Overlying by the sow was the main cause of pre-weaning loss, and accounted for 52 per cent of pre-weaning deaths. The post-weaning mortality averaged approximately 3.2 per cent for all herds.

There were considerable variations between herds both in the number of pigs born alive and in the number reared per litter. The number of pigs reared per litter ranged, between herds, from 10.5 to 5.6. Summer litters were one pig larger than winter litters, and approximately 21 per cent more pigs were born in the six months April to September than in October to March. During the year 23.5 per cent of the original sows left the herds, 20 per cent as sales and 3.5 per cent as deaths. Of the sows used 70 per cent were Large White, 10 per cent were Essex and Wessex, 10 per cent were Middle White, and 10 per cent comprised a mixture of various breeds and crosses. Ninety per cent of the boars were Large White.

The main causes of avoidable financial loss in the herds with low profits were :

- (1) High rate of food consumption per lb. live weight gain.
- (2) Unnecessarily expensive rations.
- (3) High pre- and post-weaning mortality.
- (4) Too great expenditure on labour.

Chapter V contains a short account of the organization of some profitable herds, while the final chapter deals with technical and administrative problems met in the present scheme, and the scope for the development of such work as an "efficiency service" for pig producers.

**Changes in the Economic Organisation of Agriculture—A Comparative Study of Conditions in the Eastern Counties of England in 1937 and 1936.**

*Fm Econ. Br. Rep.* No. 26. Pp. iv + 34. Price 1/6 net. Postage 2d.

The year 1937 witnessed a recession both in output and profits on the farms covered by this investigation. In so far as the reduction in output is concerned the very bad weather conditions associated with the first five months of the year must be largely responsible; in regard to the drop in profit the two outstanding factors are the low crop yields (particularly of wheat and sugar beet) and the rise in feeding stuff prices. In 1937 roughly four-tenths of the farmers concerned experienced appreciably lower returns than in the previous year, and on the average profits fell by 20 per cent., or by about 6/6 per acre. Decreased profits were evident in three out of the four "type of farming" districts here dealt with, the fall being most pronounced on the heavy arable clays of south-west Suffolk and north-west Essex, and in south Essex.

The decrease in profits is due more to a reduction in gross incomes than to a rise in gross charges. On the income side there have been declines in the gross receipts from milk, pigs, poultry, wheat, sugar beet, and "miscellaneous", while there have been increases in cattle, barley, and "other crops". On the expenditure side there have been rises in labour, foods, rent, livestock, seeds, and fuel, and falls in fertilizers, milk levies and transport, "other transport", equipment, tackle hire, and "miscellaneous". On the average gross incomes have fallen by 2 per cent and gross charges have risen by 1 per cent.

The changes in gross incomes and gross charges have been caused partly by alterations in unit prices, and partly by both quantitative and qualitative changes in the goods sold and bought. The quantity of milk sold in 1937 was less than in 1936, while the "output" (measured in numbers) of pigs, sheep, and poultry also declined. There was some increase in the output of cattle and eggs, but collectively the quantitative output of all livestock and livestock products fell by 3 per cent. In regard to crops, there was a marked drop in the quantity of sugar beet sold and some decrease in both wheat and barley. For all the 1937 crops together the quantitative output fell by approximately 12 per cent as compared with the previous year. Together the quantitative output of crops and livestock in 1937 was some 7 per cent less than in 1936.

The number of workers employed on these farms during 1937 was 2 per cent less than in the previous year, while earnings per worker averaged 3 per cent higher. Although earnings per worker increased, both the quantitative and monetary output per worker fell, the former by 5 per cent and the latter by 1 per cent. This reduction in output per worker is in sharp contrast to the general tendency of recent years.

The quantity both of feeding stuffs and fertilizers bought in 1937 was less than in 1936. This is the first time since 1932 that a contraction in the purchase of these two requirements has been noted in these surveys.

**Management in Pig Production.**

*Fm Econ. Br. Fmrs' Bull.* No. 7. Price 6d. Post Free.

The purpose of this bulletin is to provide practical farmers with information likely to be useful to them in the management of their pigs. It summarizes in simple language the main points dealt with in Report 25 (see above), e.g. the importance of good and frequent litters, of controlling food consumption, of good feeding methods, of good housing, etc. The organization of three profitable herds is described in detail, and standards of performance are given with which the individual farmer can compare his own results.

CARSLAW, R. McG.

**Are Costs the Best Basis for Price-Fixing?**

*Brit. Sugar Beet Rev.* 1937, 11, 43–46.

CARSLAW, R. McG.

**Fertilisers—the Cheapest Raw Material.**

*Fmr & Stk-Breed.* 1938, 52, 331.

CARSLAW, R. McG.

**The Land and the Nation. VI. Fundamentals of Fertility.**

*Field.* 1938, 171 (No. 4437), 66–67.

CARSLAW, R. McG.

**Production from the Soil.**

*Times*. 14th March, 1938, p. 20.

537\* CARSLAW, R. McG. & GRAVES, P. E.

**Farm Organisation on the Black Fens of the Isle of Ely.**

*J. R. Agric. Soc.* 1937, **98**, 35-52.

The Fen district round the Wash extends to about 800,000 acres, and comprises the richest farming land in Britain. The soil on rather more than half of this area is a silt deposit, while rather less than half is a form of peat derived from decayed fresh water plants. The silts and peats must be clearly distinguished, as they have different agricultural characteristics.

The present study deals with farm organization on the peat soils in 1936. Capitalization, employment, and output per acre are here on a much more intensive scale than in neighbouring upland districts. The capital value of farm live stock, crops, and equipment averages nearly £25 per acre, sales approximate £20 per acre, while employment is at the rate of five workers per 100 acres.

Crops are the principal source of revenue, representing nearly 80 per cent of gross incomes. The principal cash crops are sugar beet, potatoes, and wheat. Sugar beet and potatoes together account for half the arable area and represent nearly 60 per cent of gross incomes.

The output per worker is relatively high, partly on account of the type of crop grown, and partly as a result of mechanization and good management. Dependence on imported casual labour is less marked than might be expected, as the wives and families of regular employees undertake much of the seasonal operations.

Drainage, although an ever present problem, appears to be generally satisfactory and efficient.

CARSLAW, R. McG. & GRAVES, P. E.

**Farm Organisation on Black Fenland Soils.**

*Fm Econ.* 1937, **2**, 141-142.

CARSLAW, R. McG. and McMILLAN, J. A.

**The Agriculture of Cambridgeshire.** Contribution to *A Scientific Survey of the Cambridge District*, prepared for the Cambridge Meeting of the British Association.

Camb. Univ. Press, 1938. Price 6s.

GRAVES, P. E.

**Rural Roads.**

*Fm Econ.* 1938, **2**, 172-174.

In fourteen Cambridgeshire parishes it was found that out of 218 miles of roadway only 111 miles were public metalled roads, the balance comprising 61 miles of public unmetalled roads and 46 miles of private roads. The average land area per mile of total roadways varied between individual parishes from 182 acres to 333 acres. Attention is drawn to the importance of adequate road facilities, and the need for improvement in certain districts.

HAMMOND, J.

**Is Our Mutton Marketing at Fault?**

*Fmr & Stk-Breed.* 1938, **52**, 1880.

536\* MACGREGOR, J. J.

**The Economic History of Two Rural Estates in Cambridgeshire, 1870-1934.**

*J. R. Agric. Soc.* 1937, **98**, 142-161.

MENZIES-KITCHIN, A. W.

**How to Prevent Waste.**

*Fmr & Stk-Breed.* 1938, **52**, 607.

MENZIES-KITCHIN, A. W.

**Small-Holdings and Land Settlement.**

*Times. Brit. Agric. No. 1st Feb., 1938, p. xxxi.*

NICHOLSON, H. H.

**What it Costs to Drain a Farm.**

*Fmrs' Whly. 1938, 8 (No. 11), 46.*

PETTIT, G. H. N.

**Food Recording Facts.**

*Dairy Fmr. 1938, 10, 11.*

## AGRICULTURAL ENGINEERING.

CULPIN, C.

**Farm Machinery.**

Pp. 404. With 199 illustrations. Crosby, Lockwood & Sons, Ltd., London, 1938. Price 18s.

This book has been written for the farmer and the student of agriculture with the object of providing a source of information concerning the construction, maintenance and use of farm power, implements and machines. Further, as the economics of mechanization present no simple issue, the various points involved are discussed both in general terms and in relation to specific types of equipment. With rapid developments in mechanization, much that is written concerning farm machinery tends to become rapidly out of date, but, in writing this book, broad principles rather than details have been dealt with, in order to avoid this drawback as much as possible.

The book contains chapters on tractors and on the main kinds of tillage, seeding, hay-making and harvesting machinery. Such topics as mole drainage, pumps and spraying machinery, barn machinery and dairy equipment are also dealt with, while the artificial drying of crops, the place of electricity on the farm, farm transport, and the maintenance and economic use of equipment are fully discussed. An Appendix comprising 70 pages contains much material that is especially useful to students, but at the same time is not without its value to present-day farmers. In this part of the book are chapters on fundamental mechanical principles ; the transmission and measurement of power ; friction, lubrication and bearings ; materials used in farm machinery, and internal combustion engines.

CULPIN, C.

**Sugar Beet Harvesters.**

*Impl. Mach. Rev. 1938, 63, 970-971.*

An account is given of recent events in the development of machines for lifting, topping and cleaning sugar beet in one operation. An American beet harvester that is proving successful is described, and it is pointed out that there is every probability of the successful employment of similar machines in Britain.

LEAKE, H. M. & WESTON, W. A.R. DILLON.

**Combined Seed Drill and Duster.**

*J. Minist. Agric. 1938, 45, 344-350.*

Describes the construction and use of an experimental machine to dust seed grain as it is being drilled.

## OTHER PAPERS.

CULPIN, C.

**Round North America.**

*Camb. Univ. Agric. Soc. Mag. 1938, 5 (No. 3), 21-25.*

## AGRICULTURAL ZOOLOGY (including Entomology).

PETHERBRIDGE, F. R.

### Wireworms and Sugar Beet.

*J. Minist. Agric.* 1938, **45**, 23-27.

Repr. in *Brit. Sugar Beet Rev.* 1938, **11**, 265-267.

Drilling wheat between the rows of sugar beet saved the first drilling of sugar beet in one field where a severe wireworm attack occurred. The sugar beet was destroyed on part of the field where no wheat was drilled. Figures giving plant populations and crop weights are included.

PETHERBRIDGE, F. R.

### The Wireworm Problem.

Contribution to a discussion on the subject.

*Ann. Appl. Biol.* 1938, **25**, 214.

545\* PETHERBRIDGE, F. R., STAPLEY, J. H. & THOMAS, I.

### The Beet Eelworm (*Heterodera schachtii*, Schmidt.)

*J. Minist. Agric.* 1938, **45**, 226-236.

Repr. in *Brit. Sugar Beet Rev.* 1938, **11**, 331-336, 351.

An account of the life-cycle of the beet eelworm is followed by a description of the nature of damage. Eelworms are readily spread about in soil and it is suggested that the beet eelworm in a similar way was introduced into this country. A list of host plants is given. Distribution in England is at present confined to a few centres. The effect of crop rotations on the cyst content of soils is discussed and figures covering observations over several years are included. Recommendations for control are based on rotations to exclude susceptible crops and the practices which restrict the spread of the eelworm.

PETHERBRIDGE, F. R., STAPLEY, J. H., JONES, D. P. & JONES, F. G. W.

### Investigations on Pests of Sugar Beet in England in 1937.

Paper No. 103, *Minist. Agric. Sugar Beet Res. & Educ. Comm.* (Not available for general circulation).

The bean aphis on black fly (*Aphis rumicis*) was the most noticeable beet pest of the season. Experiments shewed that spacing and manuring had no effect on the severity of aphid attack. Cutworms were unimportant during the season—a sharp contrast to the previous year. Methods to control wireworm on sugar beet yielded satisfactory results in the only trial where a sufficient wireworm attack occurred. In this trial the drilling of wheat between the rows of sugar beet saved the first drilling of sugar beet; the part of the field in which no wheat was drilled was destroyed. An attempt to control leather jackets was carried out too late to be of value. Further observations on beet eelworm are included. Figures shewing the effects of rotations on the cyst content of soils are given for a three-year period. New centres of infection are noted.

557\* PETHERBRIDGE, F. R. & THOMAS, I.

### Spraying for Plum Sawfly.

*J. Minist. Agric.* 1937, **44**, 858-865.

One spraying with 3 per cent quassia and soft soap when the "cots" of Czar plums and damsons were beginning to split gave a very good control of the plum sawfly (*Hoplocampa flava* L.). Mineral oil emulsion and derris also gave a good control, but derris and sulphonated lard oil was not quite so good. Mineral oil and derris was the only one of these washes to check the fruit tree red spider (*Oligonychus ulmi* Koch) and also the thrips (*Taeniothrips inconsequens* Uzel.).

542\* PETHERBRIDGE, F. R. & WRIGHT, D. W.

### The Cabbage Aphid.

*J. Minist. Agric.* 1938, **45**, 140-148.

An account is given of the results of an investigation carried out in the Eastern Counties on the bionomics and control of the cabbage aphid (*Brevicoryne brassicae*). It normally overwinters on various varieties of brassicae as the egg stage. In exceptionally mild winters living aphides may overwinter as well.

An experiment is described in which an extract of pyrethrum atomized on to severely attacked cauliflower plants failed to kill the aphides in the plant heart and therefore to effectively control this pest.

The larvae of a midge of the genus *Phaenobremia* are recorded for the first time as preying on this aphid.

Measures for its control are described in some detail.

THOMAS, I.

**On the Bionomics and Structure of Some Dipterous Larvae Infesting Cereals and Grasses.** 111. *Geomyza (Balioplera) tripunctata* Fall.  
*Ann. Appl. Biol.* 1938, **25**, 181-196.

In the field the chief larval host plants of *Geomyza tripunctata* Fall. are *Lolium perenne* and *L. italicum*; in the laboratory other grasses and wheat are readily attacked. The damage is similar to that caused by *Oscinella frii* L.; the larva feeds inside the grasses and kills the central shoot.

Adults emerge in March and April and there are two generations per annum; the species overwinters in the larval stage and pupation takes place inside the host plant near the base of the shoot.

The egg, the three larval instars, and the puparium are described.

527\* WRIGHT, D. W.

**The Control of Onion Fly.**

*J. Minist. Agric.* 1938, **44**, 1081-1087.

The life-history of the onion fly (*Hylemia antiqua*) as observed in the Eastern Counties is given. Measures for its control as used in Europe and North America are reviewed.

Experiments involving the use of deterrents and larval poisons are described. A very satisfactory control of the maggot was obtained by coating the seed with calomel before planting.

A statistical analysis of results obtained from the use of calomel at two rates on a series of randomized plots gave highly significant results.

A method for treating the seed is described.

#### OTHER PAPERS.

PETHERBRIDGE, F. R.

**Slugs and their Control.**

*Husbandry.* 1937, **7**, 130-131.

WARBURTON, C.

**Annual Report for 1937 of the Zoologist.**

*J. R. Agric. Soc.* 1937, **98**, 560-564.

#### ANIMAL BREEDING AND GENETICS.

EDWARDS, J.

**Season and Rate of Conception.**

*Nature.* 1938, **142**, 357.

The influence of season on rate of conception is studied by examining the ratio of multiple births to single births at different seasons of the year. It is found that there are two peaks (human statistics) of fertility—one about mid-February and the other in August.

550\* EDWARDS, J., WALTON, A. & SIEBENGA, J.

**On the Exchange of Bull Semen Between England and Holland.**

*J. Agric. Sci.* 1938, **28**, 503-508.

The results of insemination of cattle in Holland and England with semen sent from one country to the other are discussed (8 calves in Holland and 1 in England were obtained). It is concluded that the transport of bull semen between England and the Continent is a feasible proposition.

541\* HAMMOND, J.

**Recent Scientific Research on Horse Breeding Problems.**

*Trans. Yorks Agric. Soc.* 1938, **95**, 11-25.

A popular account dealing with the breeding season; the duration and frequency of the heat periods; the changes in the ovary during the cycle, illustrated by photographs of ovaries; fertility and sterility; the stallion and artificial insemination; the diagnosis of pregnancy; the duration of pregnancy; and the growth of the foal.

525\* MACIRONE, C. & WALTON, A.

**Fecundity of Male Rabbits as Determined by Dummy Matings.**

*J. Agric. Sci.* 1938, **28**, 122-134.

A method of obtaining samples of semen from rabbit males by means of a dummy and artificial vagina is described. The method is used to investigate various factors influencing the production of spermatozoa.

521\* MANSFIELD, W. S.

**The Breeding of Livestock.**

*J. Fmrs' Cl.* 1937, **6**.

MARSHALL, F. H. A. & HAMMOND, J.

**Fertility and Animal-Breeding.** 4th ed.

*Bull. No. 39, Minist. Agric.* 1937 (H.M.S.O., London. Price 1/3). (Trans. into Italian by Prof. F. Maiocco in 1937).

Essentially the same as the previous editions, but certain sections, particularly those dealing with horses, sheep and artificial insemination, have been expanded or revised in the light of recent knowledge.

PUNNETT, R. C.

**Henny Feathering in the Fowl: a Fresh Interpretation.**

*J. Genet.* 1938, **35**, 129-140.

In connexion with the nature of henny plumage in fowls the following theory is advanced:—

(1) The cortex of the ovary produces a hormone (F) which inhibits the production of typical cock-feathering under all conditions, i.e. in castrates of either sex as well as in the intact male.

(2) The testis of the male and the testis-like right gonad of the female produce a hormone (M) which reacts with a genetical factor, H, to inhibit the production of typical cock-feathering.

(3) H is a genetical factor inhibiting the development of cock-feathering, rendering it henny or intermediate. It produces its effect only in conjunction with the male hormone (M).

(4) In all breeds of fowl H is usually carried by the Y-chromosome, and is then transmitted only from mother to daughter. But at some time or other there occurred a chromosomal translocation through which H became attached to an autosome. It is now to be found in certain males, which in consequence are hen-feathered. Conversely, through the same translocation, H may be absent from the Y-chromosomes of the female, though in the great majority of cases it is probably present.

532\* WALTON, A.

**The Experimental Control of the Sex Ratio.**

*Sci. Progr.* 1938, **32**, 694-699.

Three possible methods by which the sex ratio might be controlled are discussed, namely, by sex reversal, by parthenogenesis and by separation of the male and female determining spermatozoa. All three methods have been shown experimentally on some species of animals to be feasible. The last offers the best promise as a practical method applicable to the domesticated animals and man.

463\* WALTON, A.

**Notes on Artificial Insemination of Sheep, Cattle and Horses.**

2nd ed. Pp. 1-24, 1938. *Holborn Surgical Instrument Co. Ltd., London.*

This second edition contains several alterations and additions suggested by practical experience. The number of photographs and the bibliography have been increased.

543\* WALTON, A. & HAMMOND, J.

**The Maternal Effects on Growth and Conformation in Shire Horse—Shetland Pony Crosses.**

*Proc. Roy. Soc., Lond. 'B'*. 1938, **125**, 311–335.

Reciprocal crosses between the large Shire horse and the small Shetland pony have been made by means of artificial insemination.

At birth the foals were approximately proportional in weight to the weights of their mothers and about equal to foals of the pure breeds to which the mothers belonged. The cross-foals from the Shire mare were three times the size of the cross-foals from the Shetland mares. Maternal regulation of foetal growth was very marked and obscured any genetic differences.

After weaning, when the foals were under the same nutritive conditions, genetic differences appeared. The foals from the Shire mares grew much less rapidly than pure Shire foals, and the foals from the Shetland mares grew much more rapidly than pure Shetlands. At about 18 months an equilibrium point was reached at which the relative growth rates of the cross-foals and the pure Shetland remained constant. At 3 years the difference between the reciprocal crosses is still marked and is apparently permanent.

Differences in the proportions of the animals, when size differences are eliminated, were not so marked as differences in weight and the influence of nutrition was not so obvious.

The mechanisms, by which maternal regulation may be brought about, are discussed and three possibilities suggested : (a) Maternal regulation of foetal nutrition ; (b) Maternal hormonal control ; (c) Cytoplasmic inheritance.

The bearing of these results on the theoretical concept of growth is discussed.

The experiments illustrate the interplay of nutritional and genetical factors which are involved in development.

**OTHER PAPERS.**

EDWARDS, J.

**Artificial Insemination and the British Livestock Industry.**

*Fmrs' Whly.* 1938, **8** (No. 5), 15.

GARNER, F. H.

**Bulls for Dairy and Dual Purpose Herds.**

*Cambs Milk. Rec. Soc. Yearb.* 1938, pp. 47–49.

MANSFIELD, W. S.

**What Farmers Want of the Pedigree Breeder.**

*Fmrs' Whly.* 1937, **7** (No. 24), 15.

PEACOCK, R. B.

**The Tether System of Pig Breeding.**

*Pig Breed. Annu.* 1938/39, **18**, 62–65.

**ANIMAL NUTRITION.**

515\* GARNER, F. H. & SANDERS, H. G.

**The Water Consumption of Suckling Sows.**

*J. Agric. Sci.* 1937, **27**, 638–643.

The water consumption was determined of thirty-seven Large White suckling sows that were tethered on grass. The mean consumption was 43 lb. a day, the variation between sows, and of particular sows from day to day, being particularly wide. The consumption was practically unaffected by weather and was nearly the same in summer and winter ; it was impossible to demonstrate any relation between consumption and number or weight of litter, but there was evidence of a slight decrease as lactation progressed.

It is evident from a brief discussion that exact balance experiments as to the partitions of water for its various uses in the body of the pig are badly needed. It is hoped that the facts given here may draw attention to this point which has been neglected in animal nutrition studies.

534\* HALNAN, E. T.

**On the Influence of Protein on the Fattening of Fowls.**

*J. Agric. Sci.* 1938, **28**, 341-345.

The principal change in the composition of adult fowls during fattening is shown to be an increase in the fat content of the body.

The efficiency of conversion of food energy to carcass energy is not affected by variation in the protein content of the ration within the limits studied, i.e. 5 per cent dried skim milk, 95 per cent Sussex ground oats, and 20 per cent dried skim milk, 80 per cent Sussex ground oats.

522\* HALNAN, E. T.

**A Simplified Method of Calculating Balanced Mixtures for Milk Production.**

*J. Minist. Agric.* 1937, **44**, 853-857.

By substituting for the protein equivalent and starch equivalent figures given in the usual tables of composition the gallons of milk that these amounts of protein equivalent and starch equivalent would provide for, the calculations required for balancing milk production mixtures are much reduced and the pounds of the mixture required per gallon of milk easily ascertained. Two working examples are given, one for a mixture consisting of two foods only, and the other for a mixture consisting of more than two foods.

552\* HALNAN, E. T.

**Some Observations on the Normal Variations in Composition of Light Sussex Cockerels.**

*J. Agric. Sci.* 1938, **28**, 379-392.

The big variable in carcass compositions of cockerels of the same age class is shown to be the fat content, thus rendering measurements of energy increase based on live weight increases unreliable. The protein : ash ratio of both the Light Sussex and the White Leghorn breeds is practically constant for all males or females of the same breed after the age of 7 weeks. A strongly negative correlation exists between the fat percentage of the carcass and the moisture percentage, and a strongly positive correlation between the ash of the flesh and offal and that of the bones. Evidence is presented to show that a group of 14 birds is sufficient to give a measure of the energy content of a similar group to within a variation of  $\pm$  2 per cent.

533\* MANSFIELD, W. S., TREHANE, W. R. & PEACOCK, R. B.

**Final Report of Pig Feeding Experiment Conducted on the Cambridge University Farm during 1935 and 1936.**

*J. R. Agric. Soc.* 1937, **98**, 172-185.

Fifty pairs (litter brother and litter sister) of Large White pigs were fed individually from the age of ten weeks to bacon weight. One of each pair was fed *ad lib.* its mate being fed on a restricted quantity of the same ration. As bacon weight was reached the pigs were sent to the bacon factory and the carcasses were measured.

524\* WOODMAN, H. E. & EVANS, R. E.

**The Mechanism of Cellulose Digestion in the Ruminant Organism. IV. Further Observations from *In Vitro* Studies of the Behaviour of Rumen Bacteria and their Bearing on the Problem of the Nutritive Value of Cellulose.**

*J. Agric. Sci.* 1938, **28**, 43-63.

The Cambridge workers have continued their studies of the behaviour of cellulose-splitting bacteria in artificial media in their attempts to account for the manner in which cellulose is utilized for fat production in the body of the ruminant. The behaviour of thermophilic bacteria, with an optimum temperature of fermentation in the neighbourhood of 65°C., has been compared with that of micro-organisms capable of fermenting at body temperature (37°C.). In both cases the cultures were obtained from the rumen contents of sheep.

It was shown that, in a qualitative sense, the fermentation of cellulose takes a course similar to that for glucose. This is ascribed to the fact that glucose is one of the earliest transient phases to arise during the bacterial fermentation of cellulose *in vitro* by rumen bacteria. During this breakdown, pyruvic acid, lactic acid and lower fatty acids (formic, acetic and butyric acids) may also arise. Propionic acid, the only recognized fat-precursor among the lower normal fatty acids, was not detected among the products of fermentation. Of the products actually identified, it is

unlikely that glucose escapes further breakdown when such bacterial fermentation occurs in the rumen of the animal, and the hypothesis embodying the suggestions that the fat-forming power of cellulose might be attributable to glucose formation in the rumen has been abandoned. To what extent the fat-preursors, pyruvic and lactic acids, undergo absorption from the digestive tract during cellulose digestion is to be the subject of further investigation in work with sheep in which rumen fistulas have been established.

517\* WOODMAN, H. E., EVANS, R. E. & TURPITT, W. G.

**The Nutrition of the Bacon Pig. II. The Influence of High-Protein Intake on Protein and Mineral Metabolism.**

*J. Agric. Sci.* 1937, **27**, 569-583.

Investigations have been made at Cambridge, by the methods of balance trials, of the utilization of food proteins, at different levels of protein intake, by bacon pigs throughout the period of growth from weaning to slaughter. The feeding treatments are referred to as the 'normal-protein' and the 'high-protein' diets, the former containing the amounts of white fish meal customarily used in pig-feeding, whilst the latter were derived from the normal-protein rations by the replacement of 12 per cent of barley meal by an equal weight of extracted soya bean meal. The main conclusions are as follows :

The young pigs after weaning were able to digest their food with as high an efficiency as was displayed in the later stages of growth. The extra protein in the high-protein rations had little or no effect on the extent to which the food was digested. The gilts showed a consistently higher rate of nitrogen retention than their brother hogs. This behaviour was manifested even when the protein supply in the rations of the gilts was lower than that in the rations of the hogs with which they were compared. This more efficient utilization of food protein by the gilts is held to explain the tendency of gilts to give somewhat leaner carcasses than hogs.

Nitrogen retention from the high-protein diet was no higher than from the normal-protein rations, a finding which points to the conclusion that the amount of protein in the normal rations was sufficient to meet the demands for quick growth required by modern standards of pig production. A very large proportion of the extra protein in the high-protein diet could be accounted for by the extra urea eliminated in the urine of the pigs on these rations. This result affords a scientific basis for explaining an earlier finding in this series of investigations that an increase of the protein supply beyond the levels ordinarily fed in practice leads to no gain in respect of carcass leanness.

The daily retention of nitrogen remained very much the same throughout the whole period from weaning to slaughter at 200 lb. live-weight. Indeed, the results suggest that the requirements of the bacon pig for proteins, lime and phosphoric acid do not fall off during the whole period, and that the pig at 200 lb. is still to be regarded as an immature and quickly-growing animal with a high requirement for such constructive materials as protein and minerals. The demands for chlorine from the food, however, appear to be small, and rations ordinarily used in good feeding practice are capable of supplying the animal's requirements for this constituent.

The results of palatability tests on the "green" bacon suggest that the retention of 5 per cent of white fish meal in the ration right up to slaughter may be attended with the production of slight fishy taint. Safety lies in discontinuing the use of this feeding product during the final month of feeding.

528\* WOODMAN, H. E.

**The Nutritional Aspects of Grass-drying.**

*Rep. 4th Int. Grassland Congr. Aberystwyth.* 1937, pp. 15-20.

An account of the development of fundamental grassland research at Cambridge, leading up to the proposals for grass-drying as a means of conserving young leafy grass for use in the winter feeding of live stock. (Noted in Memoir, 9, p. 20.).

WOODMAN, H. E.

**White Fish Meal as a Food for Live-Stock. 2nd ed.**

*Bull. No. 63. Minist. Agric.* 1937. (H.M.S.O., London. Price 6d. net).

**OTHER PAPERS.**

CRUICKSHANK, E. M.

**Principles and Practice of Poultry Nutrition.**

*Poult. World.* 4th Feb., 1938.

CRUICKSHANK, E. M.

**The Quality of Cod Liver Oil.**  
*Feath. World.* 25th March, 1938.

GARNER, F. H.

**The Feeding of Dairy Cows.**  
*Lancs Milk Rec. Soc. Yearb.* 1938, **9**, 32-40.

HALNAN, E. T.

**Rationing of Animals.**  
*Times. Brit. Agric.* No. 1st Feb., 1938, p. xxx.

#### ANIMAL PHYSIOLOGY.

HAMMOND, J.

**Oestrus and Ovulation in the Mare.**

*Proc. XV Intern. Physiol. Congr. Sechenov. J. Physiol. U.S.S.R.* 1938, **21**, 193-194.

By the use of vasectomized stallions, the duration of oestrus and the length of the cycle have been studied. Oestrus on the average lasts 7 days but may vary from 3 to 41 days. The luteal phase of the cycle is relatively constant in length and the variations that occur are chiefly due to the follicular phase. Ovulation occurs about 24 hours before the end of oestrus. Oestrus continues for just under or just over 24 hours after the follicle has been ruptured by hand through the rectal wall. If this is ruptured late in oestrus a *corpus luteum* forms, but if it is ruptured early no *corpus luteum* is formed and the succeeding oestrus occurs in the course of a few days. Removal of the embryo at the 54th day leads to the recurrence of oestrus within about 4 days.

MARSHALL, F. H. A.

**On the Hypophysis as the Regulator of Gonadal Rhythm.**

Contribution to *Les Hormones Sexuelles*. Pp. 243-253. Hermann & Cie, Paris, 1938.

A short summarized account of recent work done in Cambridge upon the way in which exteroceptive stimuli of different kinds play upon the anterior pituitary and thereby effect changes in the inherent gonadal endocrine cycle. The evidence falls naturally under two heads. First, there are those factors which depend in a state of nature upon the relations between the sexes but which can be imitated experimentally by electrical or other modes of stimulation, and secondly, there are environmental factors, the most fully investigated of which is the action of light and ultra-violet irradiation.

A full bibliography to the Cambridge literature is given.

WALTON, A.

**Agricultural Physiology.**  
*Sci. Progr.* 1938, **32**, 547-548.

513\* WALTON, A.

**On the Eclipse Plumage of the Mallard** (*Anas platyrhyncha platyrhyncha*).  
*J. Exp. Biol.* 1937, **14**, 440-447.

The eclipse plumage of the male mallard (*Anas platyrhyncha platyrhyncha*) which normally appears in June and July has been produced prematurely in February and March by subjecting the birds to artificial light in addition to normal daylight.

Castration of male mallards did not prevent the assumption of eclipse in the first year but did so in the second year. Regenerated tissue was not found. It is concluded that the eclipse plumage is not caused by the direct action of a testicular hormone on the feather follicle, but that removal of the testis sooner or later produces an effect on some other endocrine organ or organs which consequently ceases to be sensitive to seasonal change (light) or fails to produce the hormones which bring about eclipse.

#### OTHER PAPERS.

HALNAN, E. T.

**Internal Egg Faults in Relation to Education and Marketing.**  
*Rep. Proc. 14th Annu. Conf. Poult. Instr.* 1937, pp. 33-36.

## ANIMAL PRODUCTION.

HAMMOND, J.

**Growth and the Development of Mutton Qualities in the Sheep : A Survey of the Problems Involved in Meat Production.**

Moscow, 1937.

A Russian edition of this book, which was published in Edinburgh, 1932, and summarized in Memoir No. 4, p. 20, 1933.

512\* HAMMOND, J.

**Judging Mutton and Lamb Carcasses for their Market Suitability.**

*36th Intern. Conf. Nat. Sheep Breed. Ass.* 1937, pp. 6-26.

A short outline of modern trade requirements with regard to weight of carcasses and quality points such as tenderness, fullness of loin, shape of leg, fat covering, size of "eye" muscle, lightness of rib, and colour of meat. A scale of points for judging carcasses is suggested.

HAMMOND, J.

**A Report on the Conditions of Animal Production in Australia.**

*Pamphl. 79. Coun. Sci. Industr. Res. Aust.* 1938. (Obtainable from High Comm. N.Z., 415, Strand, London, W.C.2.).

A report on the present state of methods of production in some of the livestock industries with indications for improvement. This is considered under the following headings : General Considerations ; Beef Cattle ; Dairy Cattle ; Pigs ; Lamb and Mutton Sheep ; Miscellaneous ; Research, Education and Extension Work.

HAMMOND, J.

**Report on the Organization of Animal Research in New Zealand.**

*Bull. 63, Dep. Sci. Industr. Res., N.Z.*, 1938; and *N.Z. J. Sci. Tech.* 1938, **19**, 762-83. (Obtainable from High Comm. N.Z., 415, Strand, London, W.C.2.).

Some problems of Animal Research in New Zealand are outlined under the following headings:

- (1) Survey problems of wastage in dairy cows, sheep and pigs.
- (2) Genetical problems.
- (3) Fertility problems.
- (4) Nutritional problems, including mineral deficiencies, grazing and stocking problems and critical times for controlling the plane of nutrition.
- (5) Meat problems.
- (6) Disease.

An organization for an Animal Research Bureau is outlined under the following headings : Constitution ; Duties ; Localization of Research Institutes ; Staffing of Institutes ; Organization of Institutes ; Getting over results to the farmer.

The direction research takes under certain headings will be determined by the policy of marketing to be adopted.

HAMMOND, J.

**Science and Animal Production.**

*J. Coun. Sci. Industr. Res. Aust.* 1938, **11**, 209-220.

An account of some of the ways in which science can be applied to the problems of egg production, fertility, diagnosis of pregnancy, evolution of breeds, meat and milk production.

516\* MENZIES-KITCHIN, A. W.

**Fertility, Mortality, and Growth Rate in Pigs.**

*J. Agric. Sci.* 1937, **27**, 611-625.

This is a statistical study of data collected under the East Anglian Pig Recording Scheme in 1927-31, and although covering in some respects an insufficient number of observations, it shows how breed characteristics may be distinguished. Large White sows are more prolific than Large Black sows, but mortality up to six weeks is higher in the former breed. At six weeks, litters from both breeds contain practically the same number of pigs. At that age, however, pure-bred Large White pigs appear to be slightly heavier than those of the Large White/Large Black cross. Sows show no significant deterioration in litter size or in litter weight at six weeks up to the tenth litter, but percentage death-rate tends to increase with farrow number.

There appears to be little advantage in producing litters with more than 12 pigs at birth. In litters containing more than 12 pigs the addition in numbers is more than off-set by an increase in death-rate. There is no significant difference at six weeks between the average weights of pigs from litters of different size *at birth*. There is, however, a difference in average weight according to the number of pigs surviving *at six weeks*; the larger the *number* the lighter the pigs.

The season in which the sow farrows appears to exercise a considerable influence on survival rate at six weeks; approximately one pig more per litter surviving in the summer than in the winter months. There is a definite negative correlation between the weight of the pigs at six weeks and the age at which they reach bacon weight. But the *rate* of post-weaning growth of the heavy pig is not necessarily greater than that of the light pig. Post-weaning mortality appears to increase with increase in litter weight variation.

Litters which are fattened during winter months take longer to reach bacon weight than those fattened during summer. Rapid growth rate and high grading results are not incompatible when the conditions of suitable rations, good stock, and proper management are observed. The third and fourth week of age appears to be a critical stage in the life of the suckling pig, and especial care must be exercised in its treatment at that period.

#### OTHER PAPERS.

EDWARDS, J.

**Experimental Work on Pig Husbandry at Centres in Great Britain. School of Agriculture, Cambridge University.**

*Pig Breed. Annu.* 1938-39, **18**, 115-119.

559\* EDWARDS, J.

**Horizons in Animal Production.**  
*Nature.* 1938, **142**, 530-532.

EDWARDS, J.

**High Milk Yields and Stamina.**  
*Fmr & Stk-Breed. Yearb.* 1938, pp. 63-64, 129.

523\* HALNAN, E. T.

**Some Observations on the Effect of Pre-storage Factors on the Storage of Eggs and Poultry.**  
*Brit. Ass. Refrigeration*, 18th Jan., 1938.

MENZIES-KITCHIN, A. W.

**Mortality in Pig Production.**  
*Pig Breed. Annu.* 1938-39, **18**, 35-40.

#### FORESTRY.

THOMPSON, C. H.

**Annual Excursion of the Royal English Forestry Society at Cheltenham, July, 1937.**  
*Quart. J. For.* 1938, **32**, 57-68.

THOMPSON, C. H.

**Forestry Section at County Shows in No. 4 Division, 1937.**  
*Quart. J. For.* 1937, **31**, 320-322.

#### PLANT BREEDING AND GENETICS.

520\* BELL, G. D. H.

**The Classification and Identification of Some Two-row Varieties of Barley Cultivated in Great Britain, including a Description of the Use of Grain and Vegetative Characters for this Purpose.**

*Z. Zicht. 'A'*. 1937, **22**, 81-146.

A general description of the characters of the grain and vegetative parts of the plant which may be used for identifying and describing two-row varieties of barley. Varietal groupings based on these characters are given, and a system of classification suggested. It is pointed out that detailed

observations from germination to maturity are extremely valuable for establishing varietal characteristics and differences. In this way the developmental changes accompanying growth can be studied, and the characters utilized to establish varietal differences. For this purpose the life cycle may be conveniently divided into a number of stages, and varietal groupings established for each stage. The necessity for observing plants at similar stages of development is stressed, and the developmental changes are described.

BELL, G. D. H.

**Crops and Plant Breeding.**

*Fmr's Guide Agric. Res.* 1936. *J. R. Agric. Soc.* 1937, **98**, 195-245.

The botanical considerations in connection with the improvement of poor pastures, management, species and strain investigations and improvement are discussed briefly in the grassland section.

The second section deals with modern tendencies in plant breeding procedure. In this account the use of wide crosses, the alteration of chromosome numbers and the induction of mutations are described, and the section concludes with a discussion of the present position of plant breeding and the application of recent scientific discoveries and investigations. In this discussion the significance of cytological and genetic investigations as aids to plant breeding is particularly stressed, while the necessity for caution in the application of the so-called new methods of breeding is advised.

Breeding investigations in wheat, barley and oats are described in further sections, and a description is given of new varieties of hops. The article concludes with results of variety trials by the National Institute of Agricultural Botany, with sugar beet, spring oats and potatoes.

BELL, G. D. H.

**Report of a Visit to Certain Swedish Plant Breeding Stations, August, 1937.**

A brief account of certain aspects of the works at Svalöf, W. Weibull A.B., and the Swedish Sugar Beet Co., Hilleshög.

The methods employed, and the main objectives in the improvement of wheat, barley and oats at the Svalöf station are described, while the breeding of grasses, clovers and root crops also receives attention. A short reference to the aims and significance of the cytological work concludes the account of the work at Svalöf.

The organization and methods of investigation employed by the Swedish Sugar Beet Co. are touched upon, and the great importances of the Weibullsholm Plant Breeding Station as a wheat breeding centre is described. Just as Svalöf has originated the most valuable oat varieties for Sweden, so Weibulls' have bred some of the best wheat varieties for Swedish conditions.

The report concludes with a comparison of the organization of plant breeding in Sweden and in this country, with a general account of the more important characteristics of the Swedish technique.

BELL, G. D. H.

**Some Aspects of the Influence of Scientific Research on Plant Breeding.**

*Rep. & J. Wom. Fm & Gdn Ass.* 1938, pp. 39-43.

A semi-popular account of the methods available for the improvement of cultivated plants, and the extent to which modern scientific research may be incorporated in breeding in order that a greater control and precision may be exercised by the breeder. Although the extreme significance of new techniques based on genetic and on cytological investigations is admitted, it is suggested that there are great limitations to the application of genetic and cytological knowledge to breeding. The great difficulty is that the breeder still has to rely on his own judgment in the all important procedure of plant selection, while the characters with which he works are not amenable to simple genetic analysis and are much influenced by the growing conditions. It is stated that plant breeding was revolutionized by the early genetic works, but the early promise of genetics has not been maintained in relation to the helping of plant breeding technique.

ENGLEDOW, F. L.

**The Place of Plant Physiology and of Plant Breeding in the Advancement of British Agriculture.**

*Rep. Brit. Ass. Sect. M.* Cambridge, 1938.

530\* HOWARD, H. W.

**The Chromosome Number of the Swede, *Brassica napus L.***

*J. Genet.* 1938, **35**, 383-86.

The chromosome number of three varieties of swede was found to be  $n=19$  and  $2n=38$ . This agrees with the results of Japanese workers but not with the numbers 18 and 36 previously found by European authors.

553\* HOWARD, H. W.

**The Fertility of Amphidiploids from the Cross *Raphanus sativus* × *Brassica oleracea*.**

*J. Genet.* 1938, **36**, 239-273.

Richharia (see Memoir 9, p. 31) has described how the  $F_1$  and  $F_2$  generations of *Raphanus sativus* × *Brassica oleracea* grown at Cambridge differ from those studied by Karpechenko. The present investigations were concerned with the fertility of the  $F_3$ ,  $F_4$  and  $F_5$  generations grown at Cambridge, but they also include some aspects of the cytology of the parents and  $F_1$  generations.

In the  $F_1$  generations a variable number of bivalents are formed at meiosis. Most of these bivalents have not completely terminalized chiasmata, such as are to be expected if the pairing is between only partially homologous chromosomes. Bridges were also observed at first anaphase.

It is shown in detail how this behaviour affects the fertility of the polyploid progeny, which will not be true amphidiploids.

The cytology of later generations, and the effect of selection for increased fertility are also described and worked out. It is also shown that the difference in behaviour between the Cambridge material and that of Karpechenko would all be expected as a consequence of the chromosome pairing found at Cambridge in the  $F_1$ .

The importance of the infertility of artificial amphidiploids for plant breeders appears to be that such plants are only likely to be useful where vegetative propagation is the chief means of increasing them and where the economic product is not dependent upon the development of the fertilized ovule.

519\* SALAMAN, R. N.

**Potato Variety Production: a New Departure.**

*Gdnrs' Chron.* 1937, **102**, 326-327.

548\* SALAMAN, R. N.

**The Present State and Future Development of Potato Breeding.**

*Indian J. Agric. Sci.* 1938, **8**, 119-129.

A paper read at the Indian Science Congress, in which the specialization exhibited by potato varieties and their production is described. It is shown that whilst such specialization has had certain very beneficial results as regards cropping it has failed almost completely to protect the potato against disease. The necessity for remedying this is emphasized and the various methods by which this can be, and, in part, is being done, are described.

**OTHER PAPERS.**

SALAMAN, R. N.

**Report of the Potato Synonym Committee, 1937.**

*J. Nat. Inst. Agric. Bot.* 1938, **4**, 293-297.

**PLANT PATHOLOGY.**

529\* CHEAL, W. F. & WESTON, W. A. R. DILLON.

**Observations on Pear Scab (*Venturia pirina* Aderh.).**

*Ann. Appl. Biol.* 1938, **25**, 206-208.

Pustules of pear scab on wood older than one year are not uncommon, and it is inferred that in some cases, as yet not fully explained, the fungus evades the cork barrier and so becomes perennial.

DENNIS, R. W. G.

**A New Test Plant for Potato Virus Y.**

*Nature*, 1938, **142**, 154.

Potato Virus Y induces characteristic local lesions when inoculated to leaves of *Lycium barbarum* seedlings.

DENNIS, R. W. G.

**The Virus Content of Some Peruvian Potatoes.**

*Rep. Brit. Ass. Sect. K.* Cambridge, 1938.

547\* SALAMAN, R. N.

**A Discussion on New Aspects of Virus Disease.**

*Proc. Roy. Soc. 'B'*. 1938, **125**, 291-294.

Recent work on the strain of the X virus is given and an hypothesis developed explaining in terms of radicles within the complex protein molecule of the viruses. The occurrence of acquired immunity, mutation and conversion, all of which have been experimentally observed is described in relation to plant viruses in general and the X virus in particular.

SALAMAN, R. N.

**The Potato Virus "X" : its Strains and Reactions.**

*Philos. Trans.* 1938, **229**, 137-217. (May be obtained from the Camb. Univ. Press).

A monograph covering 6 years work on the strains of *Potato Virus I*, the X virus. Six strains have been isolated, varying in virulence from one clinically innocuous to one which is more or less lethal.

These reactions on a variety of hosts, singly and combined with other viruses, are described. The phenomena of acquired immunity is considered in detail.

SALAMAN, R. N.

**Protection Against Virus Diseases of the Potato.**

*Rep. Brit. Ass. Sect. K.* Cambridge, 1938.

SMITH, K. M.

**A Textbook of Plant Virus Diseases. Pp. X+615.**

J. & A. Churchill, London, 1937. Price 21s.

In this book the plant viruses have, for the first time, been classified, arranged in order and given names. The virus is dealt with first and its properties and mode of spread described, then the diseases caused are given in detail, together with control methods. The insect vectors are dealt with in a separate chapter.

SMITH, K. M. & MACCLELLANT, W. D.

**On the Natural Modes of Dissemination of Certain Plant Viruses.**

*Rep. Brit. Ass. Sect. K.* Cambridge, 1938.

An account is given of studies on the method of spread of viruses which have no insect vector. It has been demonstrated that in the case of *Nicotiana Virus 11* (tobacco necrosis virus) spread of the infective agent can take place in the water or in the air. Field experiments with *Solanum Virus 1* (Potato Virus X) have shown that this virus does not spread in the same manner as other potato viruses which are insect-borne and support the suggestion of Loughnane and Murphy that the virus spreads by mechanical contact of healthy and diseased plants.

544\* SMITH, K. M. & MACCLELLANT, W. D.

**The Ultrafiltration of Plant Viruses.**

*Proc. Roy. Soc. 'B'*. 1938, **125**, 295-297.

The results of ultrafiltration studies with a representative series of plant viruses are given. It is found that viruses which appear to be spherical have a definite filtration end-point but viruses which from available evidence are rod-shaped filter irregularly. This irregularity of filtration is thought to be due to aggregation of the particles.

531\* WESTON, W. A. R. DILLON.

**A Field Observation on *Ophiobolus graminis*.**  
*Ann. Appl. Biol.* 1938, **25**, 209–210.

Indicates that the oat crop in Norfolk is resistant to attack by *Ophiobolus graminis* and suggests that this disease can occur in a barley crop following sugar beet.

WESTON, W. A. R. DILLON.

**Seed Protection.**

*Trans. Brit. Mycol. Soc.* 1937, **21**, 134–138.

Discussion on laboratory and field technique for the evaluation of fungicides which are used as seed disinfectants.

#### PLANT PHYSIOLOGY.

538\* BARNELL, H. R.

**Distribution of Carbohydrates Between Component Parts of the Wheat Plant at Various Times During the Season.**

*New Phytol.* 1938, **37**, 85–112.

Samples of Rivets wheat collected at sunrise at monthly intervals during 1935 were separated into their component parts, namely; leaves, leaf-sheathes, stems, and, after emergence, ears. These parts were analysed quantitatively for the following carbohydrates: sucrose, glucose, fructose, fermentable and non-fermentable taka-diastase hydrolysis products, fructosans, and glycoside glucose.

Drifts of the percentage amounts of the various carbohydrates within each plant component were well-defined and similar to those in the other components but the time-relations varied, e.g. the percentage amount of sucrose within each tissue rose to a peak value and then fell but these peak values were attained on different dates in the different tissues: leaf before March 16; leaf-sheath, June 8; stem, July 5; ear, July 5.

As the leaf-sheath developed the percentage of sugars in the leaf tissue fell and as the stem developed that in both leaf and leaf sheath fell. The final period when condensation of sugars to starch in the ear was proceeding rapidly was marked by a decreasing sugar percentage in all tissues. Fructosans were present in all tissues, particularly noteworthy being the high concentration in the young ear and its rapid fall as starch deposition in the ear took place.

The successive accumulation and depletion of carbohydrates, first in leaves, then in leaf-sheathes, stems and finally in the ears, was clearly shown by presenting the data as amounts per 10ft.-row in each tissue.

558\* DARK, S. O. S.

**The Development of the Flowers from the Curd of Broccoli (*Brassica oleracea botrytis*).**  
*Ann. Bot.* 1938, **2**, 751–2.

The growth of the flowers from the curd of broccoli is described and illustrated.

518\* DENNIS, R. W. G.

**Boron and Plant Life: Recent Developments in Agriculture and Horticulture, 1935–37.**

*Fertil. Feed. St. J.* 1937, **22**, 479–483, 507–511, 535–538, 573–576.

A summary of literature dealing with the part played by boron in plant nutrition.

549\* HUNTER, H.

**Relation of Ear Survival to the Nitrogen Content of Certain Varieties of Barley. With a Statistical Study by H. O. Hartley.**

*J. Agric. Sci.* 1938, **28**, 472–502.

In this paper the authors have dealt with the effect of ear survival on the nitrogen content of the grain in two varieties of barley. The results obtained show that under the conditions of the experiments described high ear survival and low total nitrogen in the grain are positively correlated. Nevertheless, under conditions in which nitrogen is available to the plant subsequent to flowering the total nitrogen content of the grain is relatively high even with high ear survival.

The abscission of ear bearing tillers, irrespective of the date of abscission, resulted in a high nitrogen content in the grain of the main stem.

## SOILS AND MANURES.

554\* CHILDS, E. C.

### The Movement of Water in Heavy Soils After Irrigation.

*Soil Sci.* 1938, **46**, 95–105.

The redistribution of water throughout the soil profile, as observed by Greene in the Eastern Gezira, is shewn to be in quantitative agreement with the theory of diffusion already developed in connection with drainage studies. The theory therefore seems to be valid for heavy deep subsoils in natural field conditions. An explanation is suggested for the action of gypsum in ameliorating these heavy alkaline soils.

NICHOLSON, H. H. & HANLEY, F.

### The Soils of Cambridgeshire.

Contribution to *A Scientific Survey of the Cambridge District*, prepared for the Cambridge Meeting of the British Association.  
Camb. Univ. Press, 1938. Price 6s.

## OTHER PAPERS.

HANLEY, F.

### Local Sources of Chalk and Marl.

*Husbandry*. 1938, **8**, 89–93.

HANLEY, F.

### Norfolk and the Land Fertility Scheme.

*Husbandry*. 1938, **8**, 11–13, 49–53.

HANLEY, F.

### Notes on Manuring.

*J. Minist. Agric.* 1937–38, **44**, 680–685, 787–791, 890–895, 992–996, 1111–1116, 1232–1236 ;  
**45**, 67–72, 172–177.

NICHOLSON, H. H.

### Drainage an Essential to Fertility.

*Fmr's Wkly.* 1938, **8** (No. 9), 29.

510\* NICHOLSON, H. H.

### Points on Mole Draining.

*Husbandry*. 1937, **7**, 123–126.

556\* NICHOLSON, H. H.

### Further Points on Mole Draining.

*Husbandry*. 1938, **8**, 5–8.

511\* NICHOLSON, H. H.

### The Present Condition of Drainage as a Limiting Factor in Productivity.

*Agric. Progr.* 1937, **14**, 234–240.

SANDERS, H. G.

### The Use of Nitrogenous Manures.

*Trans. Yorks Agric. Soc.* 1938, **95**, 26–31.

## STATISTICS.

514\* COMRIE, L. J., HEY, G. B. & HUDSON, H. G.

### Application of Hollerith Equipment to an Agricultural Investigation.

*J. R. Statist. Soc. Suppl.* 1937, **4**, 210–24.

The statistical analysis of the Greg experiment at Cambridge was only made possible with completeness by the use of Hollerith equipment. In this paper the equipment is described, and its application to the present problem discussed in some detail.

FINNEY, D. J.

**The Distribution of the Ratio of Estimates of the Two Variances in a Sample from a Normal Bivariate Population.**

Biometrika. 1938, **30**, 190–92.

A mathematical derivation is reached of the distribution determined by Bose, without the use of term-by-term integration of infinite series. It is further shown how the test may be adapted when only a sample estimate of the correlation coefficient is available.

HARTLEY, H. O. (HIRSCHFELD, H. O.)

**The Distribution of the Ratio of Covariance Estimates in Two Samples Drawn from Normal Bivariate Populations.**

Biometrika. 1937, **29**, 65–79.

When two correlated variables fall to be considered in a field experiment, the covariance analysis includes the calculation of mean products for treatment and error, analogous to the mean squares in problems of one variable only. The corresponding problem to that in the analysis of variance, namely the Z-test for the comparison of treatment with error mean square, is considered, and the corresponding test, which is shown to depend upon the population coefficient of correlation between the variates is derived. The practical use of the test is illustrated.

HARTLEY, H. O.

**Studentization and Large-Sample Theory.**

*J. R. Statist. Soc. Suppl.* 1938, **5**, 80–88.

The problem is considered of the modification of the random sampling distribution of a statistic that occurs when instead of using the unknown population standard deviation an estimate is made which only involves quantities calculated from the sample. A general class of statistics is selected, and it is shown how the exact distribution function may be approximated to by the corresponding large sample distribution.

HEY, G. B.

**A New Method of Experimental Sampling Illustrated on Certain Non-normal Populations.**

Biometrika. 1938, **30**, 68–80.

The author describes the use of Hollerith machines for the rapid assembly and analysis of experimental samples, in order to investigate distribution functions. Samples were taken from four non-normal populations, and the distributions of correlation coefficients, regression coefficients, and the ratio of different estimates of variance corresponding to degrees of freedom 3 : 4, 3 : 12 and 4 : 12 were found. These agreed sufficiently well with the known distributions in the case of normal populations for it to be possible to neglect the departure from normality, when the populations are of the character of those examined.

LAWLEY, D. N.

**A Generalization of Fisher's Z-Test.**

Biometrika. 1938, **30**, 180–187.

In covariance analysis of experimental data it is important to know whether the treatment generalized variance (defined in the paper) is significantly greater than the error generalized variance or not. An extension of Hotelling's test leads to the appropriate criterion, for which the random sampling distribution is worked out. In the second part of the paper the result is applied to test the significance of the composite regression of a set of dependent variates on the independent variates.

WISHART, J.

**Crop Estimation and Its Relation to Agricultural Meteorology.**

*J. R. Statist. Soc. Suppl.* 1938, **5**, 20–25.

This was the third of a number of contributions on the subject indicated by the title, which formed a basis for subsequent general discussion. The problems dealt with are (1) the obtaining of accurate estimates of acreage and yield for the county (2) scientific work on the relation between weather and crop yields, and (3) the Precision Record Scheme. Work done in India and China is described.

535\* WISHART, J.

**Field Experiments of Factorial Design.**

*J. Agric. Sci.* 1938, **28**, 299-306.

The point is investigated that when a field experiment is of such a character that statistical analysis can separate out a number of treatment mean squares, with a single degree of freedom each, it is desirable to test these jointly for homogeneity. Otherwise there is a danger that isolated effects may be adjudged significant when there is no real effect. A test of homogeneity, due to Bartlett, is described and applied in two examples, the second of which is a uniformity trial which appeared at first sight to yield an anomalous result.

546\* WISHART, J.

**Growth-rate Determinations in Nutrition Studies with the Bacon Pig, and their Analysis.**

*Biometrika*. 1938, **30**, 16-28.

From the weekly live weights of thirty pigs given over to a nutrition experiment it is shown how to calculate the average growth rate for each pig, and also its rate of change. Statistical analysis of the results show that additional information, and of a more accurate character, is possible than if live weight gain only had been the experimental variable to be examined. In both cases an analysis of covariance, with initial weight as the concomitant variable, was carried out, and this led, with average growth rate, to a further increase of precision.

**MISCELLANEOUS.**

OXLEY, C. D.

**Occurrence of Milk Samples Yielding a Positive Reaction for Acid and Gas in Bile-salt Lactose Broth When Incubated at 30°C.**

*Soc. Agric. Bact.* 1938.

The occurrence of samples showing results positive at 30°C but negative at 37°C is noted. The greater sensitivity of the test at 30°C and its greater accuracy, as confirmed by independent tests, is shewn. It is demonstrated that fewer poor samples would escape detection by the combined methylene blue reduction test and AG+ at 30°C than by the methylene blue test combined with AG+ 37°C.

440\* SALAMAN, R. N.

**A Short Sketch of the History of the Potato.**

*Sci. Wkr.* 1938, **10**, 2-5.

439\* SALAMAN, R. N.

**The Origin of the Potato and Its Influence on Man's Early Settlement in South America.**

*Proc. Roy. Instn.* 1938, **30**, No. 141.

## PUBLICATIONS.

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**Ber. d. Ohara Institut. f. Landw. Forschung.** Bd. I, Nos. 2, 3, 6.  
**Biological Bull.** Vol. 53, No. 1.  
**Der Biologe. Jahr.** 4, Nos. 1-4, 1935.  
**Bol. do Min. da Agric. Ind. e Comm. Rio de Janeiro.** Vols. 1-2, 1929.  
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